A. O. GIRARD.

HYDRAULIC AIR COMPRESSOR.

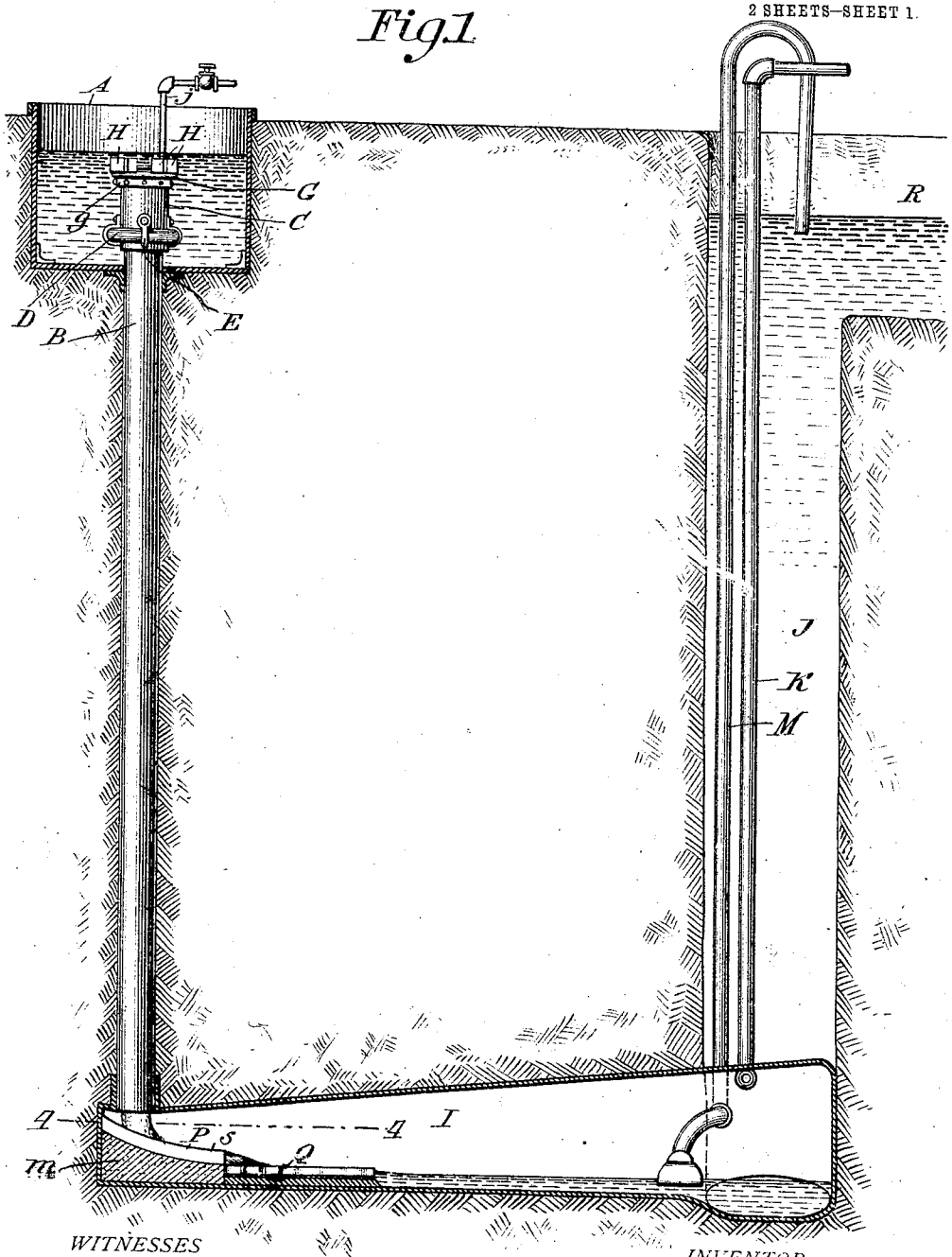
APPLICATION FILED JAN. 7, 1911.

1,007,095

Patented Oct. 31, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 2.

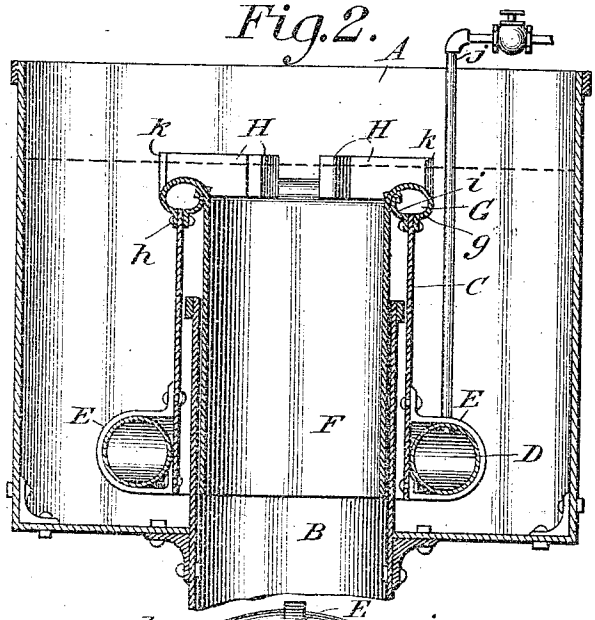


Fig. 5.

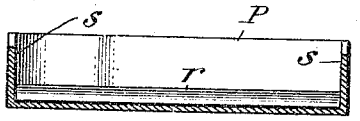


Fig. 3.

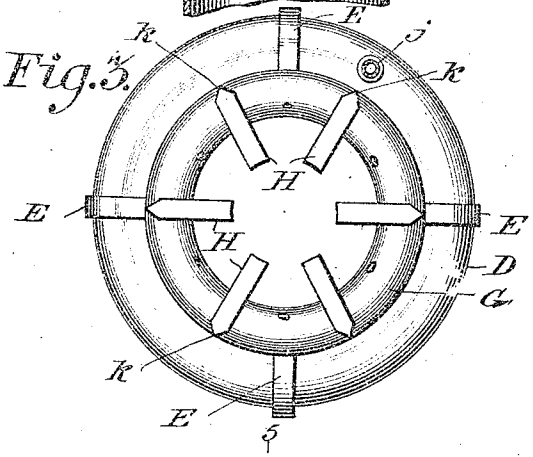


Fig. 6.

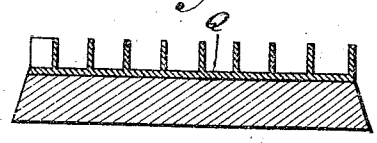
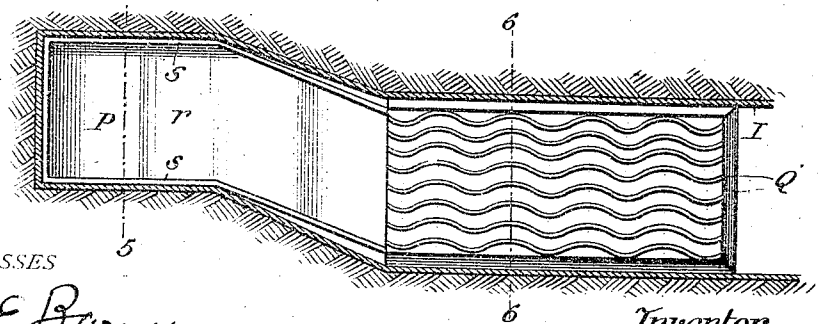


Fig. 4.



WITNESSES

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UNITED STATES PATENT OFFICE.

ALFRED O. GIRARD, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO AMERICAN HYDRAULIC AIR-COMPRESSOR COMPANY, A CORPORATION OF WISCONSIN.

HYDRAULIC AIR-COMPRESSOR.

1,007,095. Specification of Letters Patent. Patented Oct. 31, 1911.

Application filed January 7, 1911. Serial No. 601,375.

To all whom it may concern:

Be it known that I, ALFRED O. GIRARD, citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Hydraulic Air-Compressors, of which the following is a specification.

My present invention has to do with hydraulic air compressors; and it consists, as hereinafter described and claimed, in the peculiar and advantageous means for entraining air with water as the latter passes into a pipe constituting a descending conduit, and in the peculiar and advantageous means for accelerating the separation of air from the water in the chamber in which the compression of the air takes place.

In the drawings which are hereby made a part hereof: Figure 1 is a vertical section of a hydraulic air-compressing apparatus constituting the best practical embodiment of my invention that I have as yet devised. Fig. 2 is a vertical section, on an enlarged scale, illustrating the receiving end of the vertically disposed pipe positioned in the holder that is adapted to receive water from any suitable source of supply, and also illustrating my novel float and the air-entraining means thereon, as properly arranged in the body of water in the holder and relative to said vertically disposed pipe. Fig. 3 is a detail plan illustrative of the upper end of the float and the air-entraining means thereon. Fig. 4 is a horizontal section taken in the plane indicated by the line 4—4 of Fig. 1, looking downward, and illustrating the means for accelerating or promoting the separation of the entrained air from the water in the chamber where the compression of the air takes place. Figs. 5 and 6 are transverse vertical sections taken in the planes indicated by the lines 5—5 and 6—6, respectively, of Fig. 4, looking toward the left.

Similar letters designate corresponding parts in all of the views of the drawings, referring to which:

A is a holder for water, open to the atmosphere at its top and adapted to be supplied with water from any source and in any manner consonant with the purpose of my invention. Extending upward into the said holder A is a vertically disposed pipe B that is calculated to form a descending conduit for water, and surrounding that portion of the pipe that is within the holder A is the outer cylinder C of my novel float.

In addition to the outer cylinder C mentioned in the foregoing, the peculiar and advantageous float comprises a buoyant annulus D that is connected by straps E or otherwise to the lower portion of the cylinder C and surrounds the same, an inner cylinder F neatly fitted within the pipe B so as to guide the float in its rectilinear movements and prevent binding of the float in or on the pipe, an outwardly extending flange G, of convex form in cross-section, formed integral with the cylinder F and reaching above and beyond the upper edge of the outer cylinder C and having a depending portion *g* bolted or otherwise fixed to the said cylinder C at *h*, and a brace or braces *i* interposed between and connected to the upper portions of the cylinders C and F, in order to strengthen the connection of the said cylinders and at the same time hold the cylinders in proper spaced relation. By reason of the described construction of the float, the same is enabled to freely move up and down with respect to the pipe B, and is also enabled to guide a proper strata or layer of water from the body of water in the holder A into the cylinder F, from whence the water can freely pass down the pipe B. I prefer to make the buoyant annulus D of the float hollow, and to charge it with air under pressure through the pipe *j*, but I do not desire to be understood as confining myself to such specific annulus or buoyant device, inasmuch as any suitable buoyant device may be employed without involving departure from the scope of my invention as claimed. I would have it understood, however, that the arrangement of the annular float around the lower end of the outer cylinder C is advantageous since it enables the float to move the two connected cylinders F and C vertically without liability of binding of the same against the pipe F.

Fixed in suitable manner upon the flange G of my novel float and extending upward and inward from said flange, are vertical radially disposed blades H which constitute the novel air-entraining means of my invention. The said blades are tapered at their

outer ends, as indicated by *k*, and are adapted as the layer of water flows horizontally between them and into the inner cylinder F, to cleave the water so that considerable air is entrained with the water as the same enters the descending conduit. It will also be observed by reference to the drawings that the buoyancy of the float is such as to maintain the blades H in the same horizontal plane as the upper portion of the body of water, so that in passing into the cylinder F of the float the water is compelled to pass over the convex flange G and between the blades H. It will also be appreciated at this point that the capacity of the blades H in promoting the entraining of air with the inflowing water is due largely to the fact that the blades H cleave the water, and permit the portions of water to come together immediately after leaving the blunt inner ends of the blades and at the commencement of the descent of the water in the descending conduit. Notwithstanding the efficiency of the blades H in promoting the entraining of air in the water, the said blades are simple and inexpensive in construction and are well adapted to withstand the action of water. Moreover, by reason of the blades being entirely exposed at the upper end of the descending conduit, there is little or no liability of the spaces between the blades becoming clogged by debris or other foreign matter, but in the event of such matter lodging between any two of the blades the space can be expeditiously and easily cleared as soon as the lodged matter is discovered.

It will be gathered from the foregoing that by reason of the employment of the float described, my novel apparatus is adapted to operate irrespective of variations in the height of the water supplied to the holder A, and does not require the attention of any person, which of course conduces to economy in the maintenance of the apparatus.

The construction thus far described in detail constitutes what I term the intake means of the hydraulic air compressor.

At its lower end the pipe B communicates with a chamber I which, without involving departure from the scope of my invention, may be of any suitable shape.

J is an ascending water conduit which extends from the chamber I, preferably at the point illustrated with respect to the conduit A.

K is an air delivery pipe leading out of the upper part of the chamber I, and M is a blow-off pipe extending from a point within the chamber I at or adjacent the level at which it is desired to maintain the water therein. Said pipe M is preferably, though not necessarily, arranged to discharge below the surface of the water, as shown, in order to prevent the noise which would attend the discharge from said pipe into the atmosphere.

As clearly shown in Fig. 1, the conduit or pipe B communicates with the top of the chamber I, and below the discharge end of the said pipe and arranged on a suitable base or foundation *m* is a channel P having a bottom wall *r* and side walls *s*. The said channel P is slightly curved vertically in the direction of its length, Fig. 1, so as to cause the water as it leaves the pipe A to take a course at approximate right angles to the said pipe, and by reference to Fig. 4 it will be noted that the upstanding channel walls are disposed at an angle to the horizontal line of movement of the water, with the result that in moving toward the ascending conduit J the water will forcibly bring up against one of the upstanding walls *s* and will be thrown to and fro between the said walls. This agitation or manipulation of the water will have the effect of promoting and accelerating the separation of entrained air from the water, and in that way will contribute to the efficiency of the apparatus as a whole. It will also be noticed here that the agitation or manipulation of the water for the purpose described is, by reason of the specific construction referred to, accomplished without diverting the water from its approximately horizontal course, and without appreciably retarding the passage of the water or otherwise affecting the general operation and reducing the air-compressing capacity of the apparatus as a whole. For the purpose of further assuring the separation of the entrained air from the water, I provide in advance of the base or foundation *m* and below the discharge end of the channel P, the series of tortuous or serpentine channels Q, best shown in Fig. 4. The buffeting of the water in the manner described between the upstanding walls *s* of the channel P, assures the separation of the major portion of the entrained air from the water, and during the fall of the water from the channel P to the channels Q and the subsequent tortuous passage of the water through the channels Q, the remainder of the entrained air will be freed from the water.

In the operation of the apparatus, the water flows from the holder A through the float and the pipe B, and is discharged from the lower end of the pipe B upon the channel P, which serves the office of a deflector as before described. As the water flows into the inner cylinder F of the float on its way to the pipe B, air is entrained with the water. This air when released or separated from the water in the chamber I is subjected to the pressure of the water column in the ascending conduit J. After the separation of the entrained air from the water, the

water rises in the ascending conduit J and flows off from the same through a tail race R, or other suitable means provided for the purpose.

While I have shown and described one form of my invention, it is to be understood that I am not limited to the details of parts disclosed, but that modifications may be made therein without departing from the scope of the invention as defined in the claims appended.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In the intake means of a hydraulic air compressor, the combination of a descending conduit having an outwardly extending convex portion surrounding its receiving end and also having vertical radially-disposed blades extending upward and inward from the convex portion; said blades being separated by intervening spaces and being provided with tapered outer ends and blunt inner ends, and a water-holder containing the upper portion of the descending conduit and open to the atmosphere.

2. In the intake means of a hydraulic air compressor, the combination of a descending conduit open at its upper or receiving end and having vertical, radially-disposed blades extending upward from said receiving end and also extending horizontally outward and inward from said end, and a water-holder containing the upper portion of the descending conduit and open to the atmosphere.

3. In the intake means of a hydraulic air compressor, the combination of a pipe constituting a descending conduit, a water-holder containing the upper portion of the said pipe and open to the atmosphere, and a float movable vertically in said water-holder and comprising an inner cylinder movable vertically in and guided by the upper portion of the pipe and having an outwardly extending convex flange at its upper end and also having a portion depending from said flange, an outer cylinder fixed to said depending portion of the flange and surrounding the upper portion of the pipe, bracing means extending directly between and connected to the upper portions of the two cylinders, a buoyant annulus surrounding and connected with the lower end of the outer cylinder, and vertically radially-disposed blades fixed to and extending upward and inward from the said convex flange of the inner cylinder; said blades being separated by intervening spaces and being tapered at their outer ends and blunt at their inner ends.

4. In a hydraulic air-compressor, the combination of a compressed-air chamber, an ascending water conduit communicating with said chamber, a descending conduit communicating with and extending upward from the chamber and having air-entraining means on its upper portion, a water holder containing the upper portion of the descending conduit and open to the atmosphere, an air-delivery pipe leading out of the upper portion of the compressed-air chamber, and a channeled deflector arranged in the said chamber and under the descending conduit and disposed approximately horizontal to turn the water toward the ascending conduit and having upstanding side walls disposed at an angle to the line between the descending conduit and the ascending conduit to throw the water horizontally to and fro between said walls, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

ALFRED O. GIRARD.

Witnesses:
PHILIP E. BARNES,
THOMAS E. TURPIN.